



Developing a Scale to Assess Daily Health Behaviors and Perceptions among Junior High School Students

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博士論文

Developing a Scale to Assess Daily Health Behaviors and Perceptions
among Junior High School Students

(中学生の日常生活での保健行動と認識を評価する尺度の開発)

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Abstract

Background: Junior high school students are currently living in rapidly changing social and living environments and have diversified interests. Classes that encourage their intellectual curiosity are therefore needed. Junior high school is a fundamental period as students acquire healthy behaviors that may last a lifetime. However, challenges remain as these students typically do not fully apply their health education learnings to their daily lives.

Objective: The objective of this study is to design a scale that evaluates junior high school students' health behaviors and their perceptions thereof, and to clarify the relationships between junior high school students' health behaviors, perceptions thereof, daily life habits, and psychosocial factors.

Methods: A self-administered questionnaire survey, the Questionnaire on the Everyday Health Behaviors and Perceptions of Junior High School Students (Q-EHBP-JHSS), was conducted on 645 students from three junior high schools. To test the questionnaire's reliability and validity, factor validity, internal consistency, stability, and criterion-related validity were evaluated. Structural equation modeling (SEM) was also performed to understand the overall structure of the relationships between the Q-EHBP-JHSS and the Diagnostic Inventory of Health and Life Habits (DIHAL.2), Rosenberg's Self-esteem Scale (RSES), and the Children's Health Locus of Control Scale (CHLCS).

Results: There were 486 valid questionnaires from the 574 questionnaires received (89%). The exploratory and confirmatory factor analyses showed a total of 48 items under eight

factors of the Q-EHBP-JHSS. The SEM of the Q-EHBP-JHSS, DIHAL.2, RSES, and CHLCS revealed that of the eight Q-EHBP-JHSS factors, exercise, appropriate behaviors, setting times, and mobile phone use affected daily exercise, diet, and rest habits the most. These four factors were also correlated with one another. Stress avoidance/prevention was associated with students' degree of health and internal and external health locus of control, while sleep fulfillment was associated with physical and social health. Sleep regularity was associated with the external health locus of control. Exercise behavior/environment was associated with physical and social health, while physical and mental health was associated with self-esteem. Exercise consciousness affected the internal health locus of control.

Conclusions: The reliability and validity of the Q-EHBP-JHSS were confirmed. The results of SEM revealed that factors such as exercise, appropriate behaviors, setting times, and mobile phone use can be used as course content for health education that increases students' intellectual interest. Further, these results can contribute to the development of courses that support junior high school students' implementation and continuation of appropriate health behaviors.

Keywords: junior high school students, health behaviors, perceptions, scale

I Introduction

According to the US National Health Education Standards, health education aims to encourage students to adopt and sustain healthy behaviors, protect and promote their health, and directly contribute to enhancing their abilities to consistently engage in behaviors that allow them to avoid or reduce health risks¹⁾²⁾. The Fostering Competencies for Living: Junior High School Health Education Guide explains that junior high school students are living in rapidly changing social environments³⁾ and notes the importance of nurturing their abilities to voluntarily acquire the necessary information and make appropriate decisions and behavioral choices⁴⁾. According to The World Health Organization (WHO)⁵⁾⁶⁾, the acquisition of goal-setting and other life skills is important for individuals to be able to respond to problems and needs that arise in daily life constructively and effectively. Moreover, a report from the Health Education Promotion Council found that only approximately 60% of junior high school students apply what they have learned in health education to their daily lives⁷⁾, highlighting the need for a curriculum that stimulates intellectual curiosity and interest among them⁸⁾.

It is, therefore, important for health education to provide opportunities for junior high school students to relate to what they have learned in class, linking it to their personal lives so that they can adopt healthy daily habits. Furthermore, it is important for these students to selectively adopt the information they need from the plethora of health-related information, understand it, and convert it into positive behaviors.

Junior high school students experience the development of the ego and a budding awareness of the gaps between their own interests and those of others. As such, how they are viewed by their peers is a major concern among individuals of this age group⁹⁾¹⁰⁾. School is a central part of junior high school students' lives, and fostering friendships is

the leading interest among Japanese junior high school students¹¹⁾. Furthermore, these students are spending an increasing number of hours on the internet communicating with their peers via social networking sites (SNS)¹²⁾, which raise the issue of associated health problems¹³⁾. Schools are expected to implement measures to counter these issues, while also taking into account the developmental stages and interests of junior high school students. Educators have made various attempts to do so in practicums and experiments¹⁴⁾; however, the students' perceptions of health education are poorly understood, and it is unknown whether Japan's current health education curriculum truly suits their needs and interests. Thus, this preliminary study examined junior high school students' health-related behaviors and their perceptions of these behaviors⁹⁾.

Previous studies on junior high school students' health behaviors have developed scales to objectively evaluate their daily lives in relation to their health status and daily habits¹⁵⁾, as well as a health literacy scale to assess their thinking, judgment, and expression skills in health education¹⁶⁾. Moreover, previous research has reported relationships between psychosocial factors and daily habits; for example, junior high school students who have a healthy diet and maintain good oral hygiene have high self-esteem¹⁷⁾¹⁸⁾, while those who smoke have low self-esteem¹⁹⁾. Furthermore, an internal health locus of control (HLC) in junior high school students has been linked with proactive and independent health behaviors²⁰⁾²¹⁾. However, no previous studies have investigated how junior high school students' perceptions of health behaviors relate to their daily habits.

Objectively evaluating junior high school students' health behaviors and their perceptions of these behaviors, and investigating the relationship with students' daily lifestyle habits and related psychosocial factors, would enable understanding the important health behaviors they are performing and their associated perceptions.

Designing classes based on these student health behaviors and perceptions would likely increase student interest. In turn, this would allow junior high school students to rethink their lifestyles as a matter that directly affects them, thereby encouraging them to apply content learned in health education to their personal lives. As such, this study collected data to inform the development of effective health education that is both interesting for junior high school students and encourages them to convert their learning into healthy habits and behaviors. Accordingly, the authors developed a questionnaire to evaluate junior high school students' health behaviors and their perceptions of these behaviors. The questionnaire was based on the results of the authors' previous qualitative study⁹⁾, and it aimed to elucidate the relationships between junior high school students' health behaviors, their perceptions of these behaviors, their life habits, and related psychosocial factors.

II Methods

1. Participants

This study's sample included students in the 1st to 3rd year of junior high schools that represented a variety of institution types (private and public) and locations (urban and rural). The sample size was estimated to ensure it was five times or more than the number of questionnaire items²²⁾; thus, three classes from each grade were asked to participate in the survey.

2. Survey

(1) A 62-item Questionnaire on the Everyday Health Behaviors and Perceptions of Junior High School Students (Q-EHBP-JHSS)

The draft Q-EHBP-JHSS evaluated junior high school students' daily health behaviors,

their perceptions of these behaviors, their reasons for performing them, the efforts they made to perform them, and how they applied knowledge or made choices related to them. The Q-EHBP-JHSS asked respondents to answer questions based on their health behaviors and perceptions of these behaviors in the one month prior to distribution. Respondents answered questions on a Likert scale from “never” to “always” for both their health behaviors and their perceptions of them. The questions were scored between zero and four points, with higher points indicating a higher frequency of engaging in the behavior.

To test the internal validity of the questions and the suitability of the expressions used in the survey, a pretest was conducted with 10 junior high school students in the 3rd year, which showed that the questions were sound and could be completed in an adequate time.

(2) The Japanese version of Rosenberg’s 10-item Self-esteem Scale (RSES)²³⁾

This instrument evaluates global self-esteem on a scale of one to four points, with higher scores indicating higher measures of global self-esteem.

(3) The 18-item Children’s Health Locus of Control Scale (CHLCS)²¹⁾

HLC is a concept that refers to how individuals perceive control in matters related to health or illness, classifying these perceptions into whether they believe that their health can be controlled through (1) their own efforts (internal control), (2) others, or (3) chance (external control). The questions in this instrument are answered on a scale of one to four points, with higher points indicating a higher sense of control.

(4) 47-item Diagnostic Inventory of Health and Life Habits (DIHAL.2)

This tool evaluates individual degrees of health and lifestyle habits¹⁵⁾. The DIHAL.2 comprises 47 items in four categories: degree of health, exercise, diet, and rest. Degree of health is further subclassified into “physical health” (four items), “mental health” (four

items), and “social health” (four items); exercise is further subclassified into “exercise behavior/environment” (five items) and “exercise consciousness” (three items); diet is further subclassified into “dietary balance” (seven items), dietary regularity (four items), and alcohol and cigarettes (two items); and rest is further subclassified into “taking breaks” (three items), “sleep regularity” (three items), “sleep fulfillment” (four items), and “stress avoidance/prevention” (four items). Items on alcohol and cigarette consumption that feature in the original instrument were deleted for this study.

(5) Participants’ characteristics

Participants were also asked to provide information on whether their school was public or private, its location, their grade, and gender.

3. Survey procedures

Before starting the survey, consent was obtained from the principals of the three facilities after explaining the aims and nature of the study, and the methods that would be used. The researchers then visited the junior high schools of the consenting principals and requested students’ participation in the anonymous, self-administered questionnaire survey at the end of their classes. At the same time, survey participation forms addressed to parents were distributed to the students. The questionnaires were distributed in individual envelopes. The junior high school students who agreed to participate in the survey were asked to return their completed questionnaires within one week via boxes that were placed in a specific location in their schools. To ensure the anonymity of participating students, the non-participating students were asked to re-enclose their blank surveys in the envelopes and place them inside the boxes.

Furthermore, to evaluate the test-retest reliability and stability of the draft Q-EHBP-JHSS, another survey was conducted with students at one of the participating schools a

month later. The main survey was conducted from July to September 2018.

4. Data analysis

The 62 items of the draft Q-EHBP-JHSS were analyzed using the traditional psychometric theory²⁴⁾. The face validity of the draft Q-EHBP-JHSS was tested on junior high school students by checking whether the items were written in a way that could be fully understood, and whether there were other items on health behaviors and perceptions that should be added. The responses with missing data were deleted, after which the data were assessed for ceiling and floor effects.

First, for exploratory factor analysis (EFA), the principal factor method was performed (varimax rotation). Factors with eigenvalues of 1 or more and factor loadings of 0.30 or more were selected in order to retain items determined to be important based on the results of the authors' previous qualitative research⁹⁾. Items involving associations with multiple factors and single attributions were tested by confirmatory factor analysis (CFA) to determine the model fit for factor validity. Factor names were assigned to interpretable groups. The Cronbach's α coefficient was calculated to test internal consistency. The reliability of the draft Q-EHBP-JHSS was tested using the test-retest method, and by calculating the Spearman's rank correlation coefficient and intraclass coefficient (ICC). Criterion-related validity was evaluated by using the RSES, CHLCS, and DIHAL.2, calculating the Spearman's rank correlation coefficient for the scores of the various factors of the Q-EHBP-JHSS draft to test convergent validity. Furthermore, structural equation modeling (SEM) was used to test construct validity by investigating the inter-factor structure of the Q-EHBP-JHSS draft and the measures used in the study, including Akaike's information criterion (AIC), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root mean square error of

approximation (RMSEA). To be able to apply it to junior high school health education, the structure of the Q-EHBP-JHSS draft and other associated factors was investigated. $P < 0.05$ was considered statistically significant, and Windows SPSS 26.0 and Amos 26.0 were used for statistical analysis.

5. Ethical considerations

The researcher orally explained the study's aims, nature, and methods to the junior high school students; the nature of participation was voluntary, they could opt out at any time during the survey, schools and individuals would not be identified, participants' decision to accept or decline participation was completely unrelated to their school evaluations, and their data would not be used for any other purpose than this study. A completed questionnaire was interpreted as a student's consent to participate. This information was explained to the parents in writing. The study was approved by the Ethics Committee of Kobe University Graduate School of Health Sciences (Approval no. 698).

III. Results

1. Participants' characteristics

Of the 645 students from the three consenting junior high schools, 574 returned completed questionnaires (89.0% return rate). The remaining 71 included 42, who did not return a questionnaire, and 29 whose returned questionnaires had missing data and were, therefore, deemed invalid for analysis. The 486 survey forms without any missing values for the Q-EHBP-JHSS were used for the EFA (principal factor method) and CFA. For the analysis of criterion-related validity, the 367 survey forms without any missing values for the Q-EHBP-JHSS, DIHAL.2, RSES, and CHLCS were used. A total of 283 students from one of the consenting schools were requested to participate in the test-retest

evaluation of stability, 250 of whom returned a questionnaire. The questionnaires of 120 students without missing values were analyzed. A summary is shown in Table 1. A summary is shown in Table 1.

Table 1 Background of the target group (N=486)

Grade		1			2			3			Total
Gender		Male	Female	Total	Male	Female	Total	Male	Female	Total	
Primary institution											
	Public	48	52	100	78	73	151	62	72	134	385
	Private	12	18	30	18	15	33	17	21	38	101
Region											
	Urban	21	20	41	34	31	65	25	27	52	158
	Rural	39	50	89	62	57	119	54	66	120	328

2. Item selection and factor validity

The biases, and ceiling and floor effects of the 62-item Q-EHBP-JHSS (score range 0–4 points) were evaluated. The score distributions were not normal in 41 items. The details of these items were investigated, revealing that some contained items with skewed distributions. However, by answering these questions, junior high school students were made aware that those behaviors were related to their health in the future. These items were considered essential for understanding the junior high school students' health behaviors and perceptions; thus, they were not excluded, and a principal factor analysis was performed with these questionnaire items.

Next, the principal factor analysis (varimax rotation) was performed on the 62 items, which narrowed them down to eight factors with eigenvalues of 1.0 and higher. Items with a factor loading of ≥ 0.30 were selected. Furthermore, a CFA was performed on items that were associated with multiple factors and those that were evaluated to be important even though their factor loading was less than 0.30. The item “When it is cold in my room, I do not want to open the window to ventilate it” was judged to be important, even though its factor loading was less than 0.30, because it represented a behavior that

junior high school students understood, but still did not implement. Finally, items with a good fit for AIC, GFI, CFI, and RMSEA were selected (AIC=2468.552, GFI=0.814, CFI=0.772, RMSEA=0.055), which resulted in 48 items in eight factors. The factors were named according to the items that were included within them, and the results are shown in Table 2.

Table 2 Factor analysis results of the Q-EHBP-JHSS (N=486)

Items ($\alpha=0.87$)	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8
Factor 1: I exercise to promote my health (Exercise)								
1 To improve my exercise capacity.	0.790	0.103	0.128	0.093	0.073	0.000	0.186	-0.097
2 To maintain my health.	0.765	0.160	0.234	0.136	-0.001	-0.078	0.146	0.034
3 It feels good to move my body.	0.619	0.192	0.022	0.172	0.097	0.079	0.018	-0.046
4 To sleep well.	0.613	0.175	0.225	0.050	0.088	0.053	0.098	0.086
5 To maintain my body shape.	0.610	0.122	0.181	-0.053	-0.053	-0.163	0.138	0.259
6 To keep my body fat percentage down.	0.464	0.126	0.149	0.019	-0.009	-0.100	-0.046	0.416
7 I do warm-up exercises and stretch to keep from hurting my body.	0.447	0.215	0.142	0.269	0.257	0.010	0.079	-0.035
8 So people will notice me.	0.413	0.131	-0.030	0.039	0.117	0.244	-0.036	0.239
9 I should wear athletic clothes and shoes when I exercise.	0.404	0.225	0.032	0.012	0.126	0.046	0.331	-0.064
Factor 2: I want to feel comfortable so I try to adopt appropriate behaviors (Appropriate behaviors)								
10 Eating with my family is fun	0.136	0.558	0.176	-0.008	0.092	-0.047	0.043	-0.035
11 If I eat something delicious, I am happy.	0.022	0.518	0.167	0.046	0.038	0.118	0.105	-0.008
12 When I do things I like, I should do my best.	0.192	0.478	0.127	0.065	0.040	0.057	0.130	-0.046
13 I will get sick if my room is dirty.	0.162	0.423	0.141	0.236	0.003	0.031	-0.078	0.035
14 During a meal, I am mindful of my manners (greetings, chopstick etiquette, etc.).	0.147	0.422	0.103	0.062	0.015	-0.131	0.295	0.087
15 I will get influenza if I don't ventilate my room.	0.136	0.405	0.251	0.306	0.118	-0.036	-0.079	0.103
16 I want to be praised, so I do things that I am told to do.	0.088	0.384	0.108	0.037	0.132	0.089	-0.010	0.309
17 I keep nutritional meals in mind, so I eat meat (fish) and vegetables.	0.241	0.336	0.049	0.083	0.136	-0.234	0.063	0.058
18 I'm mindful of my words and attitude so that others don't dislike me.	0.177	0.302	0.121	0.084	0.053	-0.193	0.110	0.137
Factor 3: I set my own times for my daily activities so that I don't get tired the next day (Setting times)								
19 Deciding on a time to study is important.	0.071	0.211	0.676	0.138	0.133	-0.029	0.112	-0.039
20 Setting a limit on how much time I spend on my smartphone is important.	0.055	0.106	0.605	0.141	0.359	0.001	0.014	-0.075
21 Having a set time for sleeping is important.	0.129	0.263	0.594	0.214	0.147	-0.017	0.019	-0.109
22 My eyes get worse the more I use my smartphone.	0.066	0.089	0.491	0.046	0.064	-0.083	0.054	0.089
23 Get enough sleep to avoid falling asleep in class.	0.289	0.129	0.436	0.232	0.186	-0.013	-0.005	-0.004
24 Doing the same things every day is important.	0.229	0.242	0.354	0.036	0.156	-0.083	0.190	-0.093
25 I won't be able to eat dinner if I snack too much between meals.	0.141	0.082	0.345	-0.019	-0.011	-0.212	0.127	0.087
26 Time passes by really fast when I use my smartphone.	0.091	0.066	0.310	0.007	-0.114	0.013	0.094	0.052
Factor 4: I wash my hands to stay clean (Handwashing)								
27 I wash my hands because I don't like the bacteria that gets on them.	0.147	0.156	0.079	0.841	0.109	-0.018	0.169	0.080
28 I wash my hands to prevent the common cold and influenza, among other things.	0.121	0.137	0.077	0.732	0.145	-0.024	0.213	0.044
29 I feel weird if I don't wash my hands.	0.081	0.234	0.175	0.649	-0.017	-0.046	0.135	0.127
30 I think washing my hands with soap is bothersome.	-0.015	-0.105	-0.117	-0.390	0.040	0.237	-0.093	0.134
Factor 5: I decide how much time I spend on my smartphone to protect my health and my goals (Mobile phone use)								
31 I straighten my spine/back when I use my smartphone.	0.092	0.158	0.026	0.062	0.709	-0.096	-0.022	0.104
32 I use my smartphone for a preset amount of time.	0.127	0.104	0.185	0.010	0.673	-0.084	-0.001	0.011
33 After I get home, I do what I have to do early so that I can go to sleep early.	0.192	0.133	0.207	0.197	0.339	-0.070	0.082	-0.029
Factor 6: I eat food that I like because I want to eat delicious things (Eating favorite foods)								
34 Meat (fish) tastes better, so I rarely eat vegetables.	-0.061	-0.176	0.015	-0.057	0.050	0.595	0.013	0.087
35 I eat a lot of meat because I like it.	0.187	0.105	-0.093	-0.014	-0.053	0.554	-0.082	-0.068
36 Even if it's good for me, if I don't like something, I won't eat it.	-0.072	-0.134	-0.016	-0.029	0.063	0.498	0.067	0.132
37 Even if it's bad for me, if I like something, I will eat it.	-0.038	0.038	-0.062	-0.078	-0.143	0.384	0.011	0.006
38 So long as my stomach feels full, I think it's fine.	0.127	0.161	-0.008	-0.021	-0.121	0.317	0.063	0.018
Factor 7: I want to be considered a clean person, so I keep myself clean (Keeping clean)								
39 I change my undergarments for fresh ones every day.	-0.009	0.047	0.104	0.011	0.001	0.012	0.557	-0.040
40 I wear my gym clothes once, and then I wash them.	0.104	-0.023	0.021	0.097	0.017	0.044	0.425	0.087
41 If I don't use the bath (bath in shower area inc.), I feel weird	0.117	0.249	0.071	0.133	-0.153	0.011	0.411	0.008
42 I wear more or less clothes according to the temperature.	0.163	0.339	0.098	0.120	0.061	-0.047	0.362	-0.035
43 I don't want to get cavities, so I brush my teeth.	0.179	0.058	0.110	0.254	0.086	-0.060	0.346	-0.008
Factor 8: Things that I want to do take priority over my health (My priorities)								
44 I want my nails to be seen as beautiful, so I keep them long.	-0.006	0.109	-0.041	0.009	0.003	0.047	0.028	0.476
45 I don't want to gain weight, so I don't eat things with a lot of calories.	0.057	-0.089	0.068	0.077	0.121	-0.114	0.041	0.439
46 Even if it's cold, I wear one layer of clothes because I care about my appearance in winter.	0.063	0.051	0.040	0.044	-0.067	0.204	-0.070	0.388
47 I think it's good to get influenza since I get to stay home from school.	-0.035	-0.025	-0.186	-0.195	-0.224	0.135	-0.026	0.347
48 When it's cold in my room, I don't want to open the window to ventilate my room.	-0.015	0.045	-0.047	-0.189	-0.021	0.143	0.079	0.170
Sum of squared factor loadings	3.793	2.756	2.617	2.538	1.773	1.710	1.571	1.347
Factor contribution ratio (%)	7.437	5.404	5.132	4.977	3.477	3.352	3.081	2.641
Cumulative contribution ratio (%)	7.437	12.842	17.974	22.951	26.428	29.780	32.860	35.501

Values are standardized factor loadings (standardized coefficients)

Items that, if included, make interpretation and naming of factors difficult (48)

3. Reliability

The Cronbach's α coefficient of internal consistency was 0.44–0.85, while the Spearman's rank correlation for the test-retest method of stability was 0.53–0.69, and the ICC was 0.46–0.77, as presented in Table 3.

Table 3 Internal Consistency and Stability of the Q-EHBP-JHSS
(N=486, n=120 (ICC, ρ))

	Number of items	Score range	Mean(SD)	α^a	ICC ^b	ρ^c
Exercise	9	0-36	22.2 (7.6)	0.85	0.60	0.60***
Appropriate behaviors	9	0-36	27.7 (5.1)	0.73	0.67	0.65***
Setting times	8	0-32	25.5 (5.3)	0.76	0.54	0.53***
Handwashing	4	0-16	12.0 (3.5)	0.77	0.71	0.67***
Mobile phone use	3	0-12	5.4 (3.1)	0.66	0.57	0.57***
Eating favorite foods	5	0-20	9.7 (3.5)	0.58	0.62	0.61***
Keeping clean	5	0-20	18.3 (2.0)	0.54	0.77	0.69***
My priorities	5	0-20	12.1 (2.9)	0.44	0.46	0.53***

^aCronbach's alpha

^bIntraclass correlation coefficients

^cSpearman's rank correlation coefficient *** $P < 0.001$

4. Criterion-related validity

The relationships between the scores for the various factors of the Q-EHBP-JHSS and DIHAL.2, CHLCS, and RSES were investigated for criterion-related validity. Table 4 shows that Factors 1, 2, 3, and 5 of the Q-EHBP-JHSS were strongly correlated with the DIHAL.2, which measures daily habits ($P < 0.001$). The factors of the DIHAL.2 were also strongly correlated, as shown in Table 5.

Table 4 Relationship between the Q-EHBP-JHS and DIHAL.2, CHLCS, and RSES (N=367)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
	Exercise	Appropriate behaviors	Setting times	Hand-washing	Mobile phone use	Eating favorite foods	Keeping clean	My priority
DIHAL.2								
Degree of Health								
Physical health	0.369 ***	0.409 ***	0.334 ***	0.139 **	0.384 ***	0.095	0.266 ***	0.165 **
Mental health	0.106 *	0.229 ***	0.202 ***	0.143 **	0.183 ***	0.065	0.215 ***	0.164 **
Social health	0.371 ***	0.381 ***	0.266 ***	0.184 ***	0.266 ***	-0.024	0.221 ***	0.131 *
Life Habit (Exercise,Diet,Rest)								
Exercise								
Exercise behavior/environment	0.505 ***	0.270 ***	0.229 ***	0.134 **	0.160 **	-0.018	0.310 ***	0.037
Exercise consciousness	0.601 ***	0.378 ***	0.333 ***	0.153 **	0.220 ***	-0.070	0.307 ***	0.032
Diet								
Dietary balance	0.283 ***	0.505 ***	0.302 ***	0.230 ***	0.275 ***	0.256 ***	0.234 ***	0.074
Dietary regularity	0.262 ***	0.311 ***	0.358 ***	0.160 **	0.290 ***	0.161 **	0.300 ***	0.157 **
Rest								
Taking breaks	0.123 *	0.182 ***	0.165 **	0.128 *	0.271 ***	0.004	0.061	0.100
Sleep regularity	0.276 ***	0.231 ***	0.325 ***	0.163 **	0.411 ***	0.113 *	0.194 ***	0.200 ***
Sleep fulfillment	0.297 ***	0.256 ***	0.343 ***	0.130 *	0.426 ***	0.077	0.166 **	0.270 ***
Stress avoidance/prevention	0.380 ***	0.491 ***	0.393 ***	0.232 ***	0.360 ***	0.027	0.285 ***	0.131 *
CHLCS								
Internality	0.391 ***	0.506 ***	0.418 ***	0.264 ***	0.243 ***	0.013	0.236 ***	0.170 **
Powerful others externality	0.235 ***	0.357 ***	0.285 ***	0.263 ***	0.241 ***	0.027	0.190 ***	0.130 *
Chance externality	-0.036	-0.101	-0.115 *	-0.142 **	-0.133 *	-0.218 ***	-0.106 *	-0.208 ***
RSES								
Self-esteem	0.212 ***	0.238 ***	0.168 **	0.103 *	0.201 ***	0.036	0.173 **	0.125 *

Spearman's rank correlation coefficients * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 5 Association between DIHAL.2 factors (N=367)

	Degree of Health			Life Habit (Exercise, Diet, Rest)							
	Physical health	Mental health	Social health	Exercise		Diet		Rest			
				Exercise behavior/environment	Exercise consciousness	Dietary balance	Dietary regularity	Taking breaks	Sleep regularity	Sleep fulfillment	Stress avoidance/prevention
Degree of Health											
Physical health											
Mental health	0.370 ***										
Social health	0.518 ***	0.330 ***									
Life Habit (Exercise, Diet, Rest)											
Exercise											
Exercise behavior/environment	0.464 ***	0.330 ***	0.499 ***								
Exercise consciousness	0.471 ***	0.322 ***	0.487 ***	0.735 ***							
Diet											
Dietary balance	0.491 ***	0.207 ***	0.380 ***	0.367 ***	0.366 ***						
Dietary regularity	0.421 ***	0.258 ***	0.265 ***	0.280 ***	0.313 ***	0.435 ***					
Rest											
Taking breaks	0.416 ***	0.245 ***	0.280 ***	0.194 ***	0.234 ***	0.391 ***	0.221 ***				
Sleep regularity	0.450 ***	0.224 ***	0.255 ***	0.230 ***	0.264 ***	0.310 ***	0.607 ***	0.357 ***			
Sleep fulfillment	0.639 ***	0.400 ***	0.376 ***	0.377 ***	0.382 ***	0.387 ***	0.433 ***	0.427 ***	0.530 ***		
Stress avoidance/prevention	0.666 ***	0.438 ***	0.559 ***	0.448 ***	0.482 ***	0.496 ***	0.375 ***	0.437 ***	0.400 ***	0.549 ***	

Spearman's rank correlation coefficients *** $P < 0.001$.

5. Structural equation modeling

The overall structure of the relationships between the Q-EHBP-JHSS and DIHAL.2, RSES, and CHLCS was investigated. Several possible models were created based on the factors with high correlation coefficients in Tables 4 and 5, to select those with the best model fit, resulting in AIC=8963.262, GFI=0.662, CFI=0.685, and RMSEA=0.052 (Figure 1). Correlations were observed between the Q-EHBP-JHSS factors of setting times (F3), exercise (F1), appropriate behaviors (F2), and mobile phone use (F5), and these four factors affected the DIHAL.2. Setting times affected the daily diet and rest habits measured by the DIHAL.2. Thus, the Q-EHBP-JHSS factors affected students' daily habits measured by the DIHAL.2, and these daily habits, in turn, affected the students' degree of health in the DIHAL.2 and the CHLC. Furthermore, students' physical and mental health (under the DIHAL.2 degree of health category) affected their self-esteem. The Q-EHBP-JHSS factor of appropriate behaviors (F2) was strongly correlated with exercise (F1) and setting times (F3), and had a wide effect on the aspects measured by the DIHAL.2, including exercise, diet, and rest. Specifically, stress avoidance or prevention in the DIHAL.2 rest category affected students' responses for all items under the degree of health and internal and external control, as measured by the CHLC. Moreover, their physical and mental health affected self-esteem, and the standardized coefficients were 0.26–0.76 ($P < 0.001$).

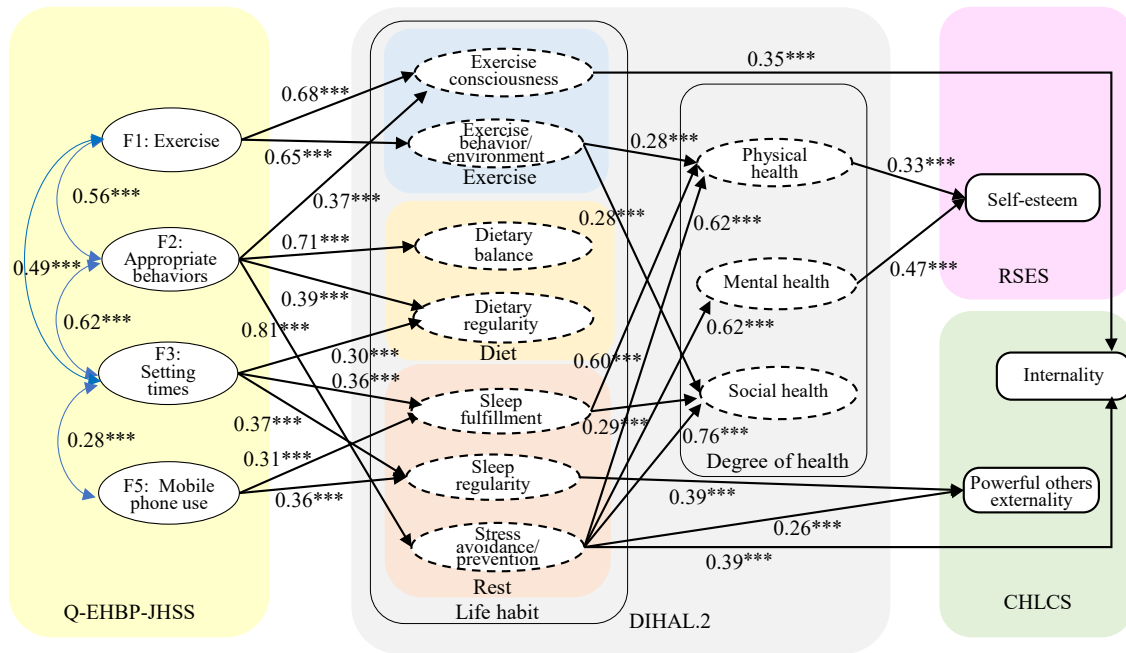


Figure 1. Structural equation modeling of component factor of Q-EHBP-JHSS and DIHAL.2, RSES, CHLCS (N=367)

→ : Standardized coefficients *** $P < 0.001$

↔ : Correlation coefficients

IV. Discussion

The Q-EHBP-JHSS was created based on comments from junior high school students⁹⁾ and can be used as a scale to evaluate their health behaviors and perceptions of these behaviors. Content that stimulates the intellectual curiosity and interests of junior high school students is advocated in health education⁸⁾²⁵⁾, and results of structural analyses, including those of the Q-EHBP-JHSS, can be applied when designing health classes that focus on the real-life perceptions and behaviors of junior high school students.

1. Reliability and validity of the Q-EHBP-JHSS

(1) Evaluating data using the Q-EHBP-JHSS

The Q-EHBP-JHSS encompassed eight factors, which showed that, in terms of their classes and after-school activities, the junior high school-aged adolescents' time management was centered around their school lives and they wished to form adequate

daily habits on their own. The exercise factor (F1) in the Q-EHBP-JHSS comprised nine items, including those that examine students' desires to improve or maintain their athletic abilities, improve their body shape, be seen as attractive, and gain the attention of others. Associated with these items, the setting times factor (F3) reflected how students set their own schedules, for example, when they study or go to bed to ensure getting sufficient sleep and concentrating during class. Furthermore, their responses to the mobile phone use factor (F5) items reflected that mobile phones are an essential communication tool for junior high school students and that they devise ingenious ways to use the tool in a healthier manner, such as maintaining a good posture with their backs straight. These results collectively suggested what the junior high school students believed could help them be healthy in the central aspects of their school lives (i.e., during classes, after-school activities, and in relationships with their friends and peers), and this should be understood well by health teachers.

The factors of handwashing (F4) and keeping clean (F7) related to activities to prevent infection or changing into clean undergarments every day. Junior high school is a period characterized by adolescents' budding self-consciousness, which makes them want to rigorously maintain their personal hygiene¹⁰⁾, and these factors reflect such interests accordingly.

The appropriate behaviors factor (F2) included items such as finding it fun to eat with the family, respecting table manners, and being mindful of one's words and attitude to avoid being disliked by others. The junior high school students in this study were enjoying fun and healthy meals with their families, and strove to do their best at the things that they liked, to increase their own comfort and wellbeing. Furthermore, youngsters at this life stage begin to think about their futures and make efforts to align their behaviors to those

that mirror their ideal selves. However, the factors of eating favorite foods (F6) and the students' priorities (F8) included items unrelated to being healthy, such as eating things they like even if they are bad for them and growing their nails long because they want to be perceived as beautiful. These items suggest that the budding egos of junior high school students lead them to behave based on their own decisions in matters related to their interests, rather than obediently following the instructions of their teachers or parents.

In sum, the Q-EHBP-JHSS developed in this study was an effective questionnaire for understanding junior high school students' health behaviors in their daily school lives and their perceptions about these behaviors.

(2) Reliability and validity

The Cronbach's α coefficients were 0.44–0.85. The Q-EHBP-JHSS items for evaluating health behaviors and students' perceptions of them were varied, and due to the small number of items within some factors, some of the Cronbach's α coefficients were low. However, the scale's overall Cronbach's α coefficient was 0.87, demonstrating consistency between the items for evaluating junior high school students' health behaviors and their perceptions of these behaviors.

The test-retest method was used to confirm the stability of the test, with correlation coefficients of 0.53–0.69 and ICCs of 0.46–0.77. With regards to internal validity, EFA and CFA were performed, resulting in GFI=0.814, CFI=0.772, and RMSEA=0.055 of model fit, demonstrating internal validity. CFI and GFI ≥ 0.9 are considered indicators of good internal validity; however, the values were low due to the high number of observed parameters²⁶⁾²⁷⁾.

Concerning criterion-related validity, F1, F2, F3, F5, and F7 were correlated with all items of the DIHAL.2. However, "I wash my hands to stay clean" (F4) was not correlated

with the items of DIHAL.2. As F4 did not seem to have a direct relationship with the DIHAL.2 items of Exercise, Diet, or Rest, it was reasonable that the correlation coefficient would be low. “I eat food that I like because I want to eat delicious things” (F6) and “Things that I want to do take priority over my health” (F8) seemed to reflect the developmental traits of junior high school students who began to make their own decisions²⁸⁾, and were unrelated to their daily habits, at least not directly, indicating that the low correlation coefficients were reasonable. Therefore, the criterion-related validity of the Q-EHBP-JHSS was also confirmed.

2. Structural equation modeling

Structural analysis of the Q-EHBP-JHSS showed that four of its eight factors, that is, exercise (F1), appropriate behaviors (F2), setting times (F3), and mobile phone use (F5) remained in the structure. The indicators of model fit were AIC=8963.262, GFI=0.662, CFI=0.685, and RMSEA=0.052.

For junior high school students to understand, accept, and practice the health behaviors they learn in class, it is important for teachers to have preliminary knowledge and understanding of these students, and design their classes to pique their interests⁴⁾⁸⁾²⁵⁾. Applying the SEM results revealed in this study to class design will likely lead to the implementation of classes that enhance student interest and curiosity in health-related behaviors.

This study showed that the appropriate behaviors factor (F2) measured in the Q-EHBP-JHSS affected the highest number of daily habits evaluated by the DIHAL.2, and the subfactors were also highly correlated with one another. Thus, appropriate behaviors (F2) were an extremely important factor, with a wide effect on many related factors including the students’ life habits, degree of health, self-esteem, and internal and external locus of

control. In addition, the results revealed that junior high school students' health behaviors were motivated by the desire to have a comfortable daily life and gain the approval of others. People need their esteem needs to be met²⁹⁾, and positive self-esteem is associated with emotional happiness and wellbeing³⁰⁾³¹⁾. Junior high school students experience happiness by being positively esteemed by others through performing appropriate behaviors (F2), thereby suggesting their abilities for sound stress avoidance or prevention. Moreover, the appropriate behaviors factor (F2) included items related to meals with family, which is linked to healthier nutritional balance and regular mealtimes. Enjoyable meals with the family provide opportunities for quality time with relatives and offer other benefits, such as improving the quality of adolescents' diets³²⁾. For example, parents are the main factor determining adolescents' fruit and vegetable intake³³⁾.

The Q-EHBP-JHSS factors of setting times (F3) and mobile phone use (F5) had effects on the life habits measured by the DIHAL.2. By setting times (F3), junior high school students determined their bed, meal, and home study times to ensure sufficient sleep and, therefore, lead healthy lives. The junior high school students set realistic schedules and believed in the need to get sufficient sleep, which is a significant factor of good health and is associated with healthy behaviors³⁴⁾³⁵⁾. Furthermore, mobile phones (F5 of the Q-EHBP-JHSS) were extremely important devices for junior high school students, and while they made time to use them, they also tried to maintain a good posture while using them and set time restrictions in order to reduce the negative effects associated with the excessive use of mobile phones; for example, spending long hours on mobile phones has been found to reduce sleep time and quality, also increasing stress¹²⁾³⁶⁻³⁸⁾. Overall, the Q-EHBP-JHSS setting times (F3) and mobile phone use (F5) factors were associated with improving daily habits.

The Q-EHBP-JHSS exercise factor (F1) was an important element of, and filled a significant place in, junior high school students' daily lives, comprising their desires to improve their athletic skills, maintain their body shapes, and draw the attention of their peers. Exercise (F1) also affected the students' self-esteem indirectly via the DIHAL.2 physical health.

3. Potential applications of the Q-EHBP-JHSS in health education for junior high school students

Education plays a crucial role in instilling healthy lifelong habits among junior high school students¹⁾. Accordingly, health education has employed numerous teaching methods through trial and error to encourage junior high school students to become interested in their own health and embark on health challenges. However, the truth remains that many junior high school students understand the knowledge they learn but fail to apply it in real-life situations⁷⁾. Therefore, it is imperative for health education to ensure that junior high school students adopt what they have learned in class in their daily lives, and convert this learning into appropriate behaviors.

Among the methods used to encourage junior high school students to develop an interest in their own health, the Q-EHBP-JHSS—specifically, the four factors of F1: Exercise, F2: Appropriate behaviors, F3: Setting times, and F5: Mobile phone use—should be readily applied. These four factors embody the results of the Q-EHBP-JHSS, which is founded on the actual health behaviors performed by junior high school students and their perceptions of these behaviors and, therefore, represent the factors that affect their daily lives. Moreover, these factors are directly linked to known problems in the lifestyles of contemporary junior high school students that must be addressed, such as spending excessive hours using mobile phones and a lack of sleep. These factors also

interact with each other and cannot be solved individually without a modification of the others: For example, simply telling adolescents to go to bed early and explaining the importance of getting sufficient sleep has a limited effect on persuading them to do so.

Consequently, it is important to incite junior high school students to visualize their daily lives holistically, compare them with what they have learned in health class, and identify any problems. Becoming aware of their problems motivates students to devise ingenious ways to modify their lifestyles. These processes help junior high school students to become interested in their problems and attempt to solve them. In addition, teachers should ask students questions such as “How did you feel the day after pulling an all-nighter?” or “Were you able to concentrate on your classes when you skipped breakfast?” to prompt them to understand the relationships between their health conditions and daily habits in the process of reflecting on their lifestyles. Helping junior high school students realize this association can encourage them to formulate their own solutions to develop healthy daily habits. Such a way of interacting with junior high school students corresponds to the role of the teacher in helping them discover the challenges related to healthy lifestyles and the prevention of diseases, investigate solutions, make judgments, and attain the skills to express them, as stated in the National Curriculum Standards for Lower Secondary School³⁹⁾. Moreover, when junior high school students reflect on their daily lives, they become aware that their lifestyles are related to their health, which enables them to think of what they learn in class as something affecting them in reality. As the National Curriculum Standards for Lower Secondary School state, health educators should interact with junior high school students in inventive ways such that they engage in their health as a personal undertaking²⁵⁾. Teaching methods guided by the findings of the present study would make this possible.

In junior high school, children are at the age of ego development. Unlike their primary school counterparts, junior high school students often need to be convinced by scientific evidence or moved emotionally to be motivated to make behavioral changes, just as an adult would.

In other words, they cannot be taught effectively through management that involves the implementation of simple rules or feeding them knowledge in a unidirectional manner³⁾; thus, it is important for teachers not to simply propose healthy habits to junior high school students, but to provide instruction in such a way that the students think independently to devise their own realistic ideas.

Junior high school students must think by themselves, judge, “This is important. I think I can do this,” and find their own solutions in order to put them into daily practice. Bandura defined self-efficacy as “the conviction that one can successfully execute the behavior required to produce the outcome” and differentiated between “outcome expectancies” and “efficacy expectancies,” the latter of which corresponds to self-efficacy. This approach is also important in that, generally, unrealistically hard tasks are difficult to tackle, whereas accomplishing realistic steps corresponding to Bandura’s concepts of “efficacy expectancy” and “outcome expectancy” boosts students’ self-efficacy⁴⁰⁾.

The four factors of the Q-EHBP-JHSS, which were the outcomes of SEM, were linked to the DIHAL.2 categories and appropriate health behaviors. They were also linked with stress avoidance/prevention, self-esteem, and the internal locus of control (CHLC). They affected the external HLC through appropriate behaviors and setting times. People with high self-esteem and those who scored high on the internal HLC were reported to perform proactive health behaviors¹⁷⁻²¹⁾. Those who tended toward an external HLC were reported to be able to follow programs that offered social support (e.g., help from family) and

improved environmental conditions²⁰⁾. Reflecting on the four Q-EHBP-JHSS factors with junior high school students should lead to them adopting appropriate health behaviors and growing their self-esteem and internal HLC, which should, in turn, prompt them to become interested in their health and adopt healthy behaviors. Meanwhile, people who tend to have an external HLC should adapt through social support and environmental accommodations.

4. Limitations

This study has several limitations; the data from students of all three years of junior high school were analyzed together to test the questionnaire's reliability and validity, and analyze the relationships between the DIHAL.2 based on the Q-EHBP-JHSS and related psychosocial factors. However, junior high school students are in a stage of rapid physical and mental growth and development³⁾⁴¹⁾; therefore, it is likely that the health behaviors of students in each grade and their perceptions of them have distinct characteristics. Since a relationship between socioeconomic status and junior high school student health behaviors has been shown⁴²⁾, and it is necessary to explore the relationship of these students' health behaviors and perceptions thereof, with background factors that are likely to impact them, such as gender and socioeconomic status.

V. Conclusions

This study tested the reliability and validity of the Q-EHBP-JHSS questionnaire, which was designed to collect information on the daily health behaviors of junior high school students. The results revealed that the scale can be used to effectively understand these health behaviors and students' perceptions of them. Structural analyses revealed that the Q-EHBP-JHSS factors F1: Exercise, F2: Appropriate behaviors, F3: Setting times, and

F5: Mobile phone use affected the junior high school students' daily habits. Finally, the results suggest that the Q-EHBP-JHSS has potential for use in designing classes that are intellectually stimulating and interesting to junior high school students.

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